INNOVATION, TECHNOLOGY AND SOCIETY

PROSPECTUS FINAL REPORT: 2006 - 2010

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LIST OF ACRONYMS

ASEAN	Association of Southeast Asian Nations
ASIALICS	Asian Network for Learning, Innovation, and Competence Building Systems
ASRO	Regional Office for Southeast and East Asia
BRICS	Brazil, Russia, India, China and South Africa
CIDA	Canadian International Development Agency
ESARO	Regional Office for Eastern and Southern Africa
GLOBELICS	Global Network for Economics of Learning, Innovation, and Competence Building Systems
GMOs	Genetically Modified Organisms
iBOP	Innovations for the Base of the Pyramid
IFPRI	International Food Policy Research Institute
IPRs	Intellectual Property Rights
IPS	Innovation, Policy and Science
ITS	Innovation, Technology and Society
LAC	Latin America and the Caribbean
LACRO	Regional Office for Latin America and the Caribbean
MENA	Regional Office for the Middle East and North Africa
MERCOSUR	Mercado Común del Sur; Argentina, Brazil, Uruguay and Paraguay
NGOs	Non-governmental Organizations
NIS	National Innovation Systems
OECD	Organization for Economic Co-operation and Development
PI	Program Initiative
PO	Program Officer

RoKS	Research on Knowledge Systems
SARO	Regional Office for South Asia
SMEs	Small and medium enterprises
SPS	Sanitary and Phytosanitary Standards
STI	Science, Technology and Innovation
TIM	Total Innovation Management
TRIPs	Trade-Related Intellectual Property Rights
UILs	University Industry Linkages
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNU-MERIT	United Nations University-Maastricht Economic Research Institute on Innovation and Technology
WAITRO	World Association of Industrial and Technological Organizations
WARO	Regional Office for West and Central Africa

BACKGROUND

In March 2005, the IDRC Board of Governors (BOG) created a new Program Area on *Innovation, Policy and Science* (IPS). Following this, the BOG approved the first IPS Program Initiative (PI), Innovation, Technology and Society (ITS) in June 2006 for five years.[1] ITS was designed to build on and expand research which the Centre had supported under two explorations, namely, Research on Knowledge Systems[2] (RoKS) and the IDRC Task Force on Biotechnology and Emerging Technologies,[3] also known as *New Technologies,* as well as a half-dozen national science, technology, and innovation policy reviews.

The PI's vision was to contribute to just, equitable and sustainable social and economic development in low and middle-income countries. To achieve this, the Prospectus defined three objectives[4]:

- improving understanding, capacity and linkages of innovation system actors (organizations and individuals) in developing countries;
- supporting the development of explicit and implicit S&T policies contributing to improved functioning of developing country innovation systems; and
- strengthening socio-economic impact[5] analysis, social inclusion and learning capabilities in support of innovation and the governance of new technologies.

Since approval, ITS has had an average annual budget of about CAD $3.75 million. As of December 31, 2009, the program had funded 74 projects, worth just over CAD $16 million.[6] This included 35 research support projects and 39 research projects. Distribution by program objective and region is shown below (Figs. 1 and 2).

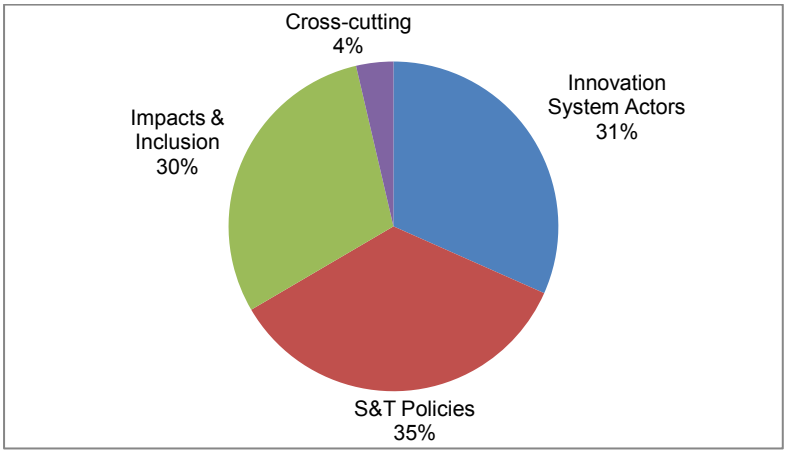

Fig. 1: Project Distribution (by budget) by Program Objectives

As shown in Figure 1, distribution by program objective is almost equal. About a third of the programming has been in Objective 1, with slightly more in Objective 2 and slightly less in Objective 3. As shown in Figure 2, about 67% of the programming has been in South East Asia, South Asia, and LAC. These distributions come as no surprise given that each of these three regions has been served by a full time Program Officer (PO).

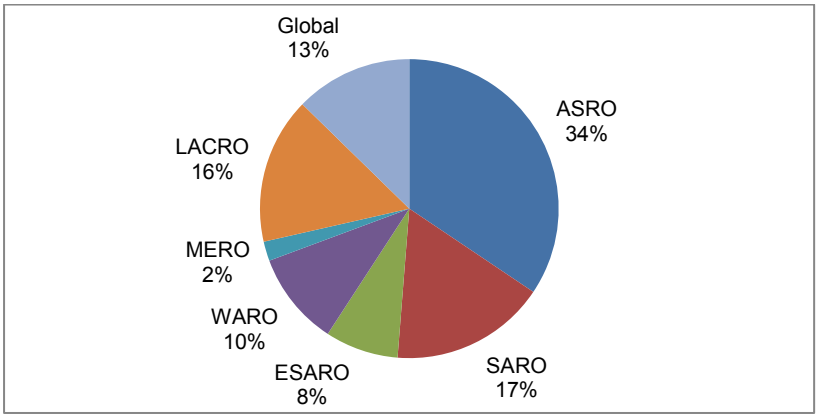

Fig. 2: Project Distribution (by budget) by Region[7]

During the first 2.5 years of the program, ITS funded a number of projects within its three objectives. For instance, under the first objective, it initiated comparative studies of national innovation systems in Brazil, Russia, India, China and South Africa (BRICS)[8], under the second, a project on policies or bioinnovation in agriculture and health,[9] and under the third, work on science journalism[10] These projects were exploratory, because ITS was a new program and innovation systems in developing countries is not a well developed field of research. At program mid-point, with the arrival of a new Director, the team stepped back to reflect on its project portfolio and to identify regional priorities. The team concluded that strengths to build on included research on biotechnology and agricultural innovations, that more work was needed on pro-poor innovation, and a new opportunity was energy policy.[11] Since then, the program has been deepening its research on these aspects, except for energy policy, which it is exploring with a single project in the upcoming year.

Key modalities that ITS has used to achieve its objectives include capacity-building, supporting networks, and competitive grants projects[12]. The program has not exclusively used these approaches, but has consistently developed some of its projects this way, in order to achieve a balanced portfolio. Capacity building of innovation system actors and the strengthening the ability to analyze the impact of emerging technologies and learn how to govern them is explicitly mentioned within two of the program objectives, so this has been an important feature of the program. As well as individual research projects, ITS has supported research networks, given that networks are important means for influencing policy, including science policy, which is the raison d'être of the program. Finally, small competitive grants projects have proven a useful mechanism to identify and support new generations of researchers in the South and also explore and scope a research area such Intellectual Property Rights, which can then be treated in a more profound way. The program has used competitive grants projects sparingly, but consistently.

IDRC has a grants plus business model to support research for development. This means that ITS has not just acted as a research funder, but also a research adviser that engages with its recipients through the research process as a mentor, and as a knowledge broker that furthers networking among its grantees, and helps strengthen research-to-policy linkages. Overall, IDRC strives to balance its principal roles of

research funder, adviser, and broker across it program map. Novel activities on new research frontiers, developing new methodologies, and those involving less experienced research partners or research partners who are new to IDRC necessitate greater engagement on the part of Centre staff as research advisers, and knowledge brokers[13]. Given that STI research in developing countries is a relatively new field and has depended to a certain extent on the development of new methodologies, ITS staff has spent considerable time as research advisers and knowledge brokers.

The program has encountered two main challenges.

First, ITS has spent considerable time on its research adviser and knowledge broker roles described above—in particular, identifying Southern research partners, mentoring them, and building partnerships amongst them. Given the often weak capacity for STI research and policy development in developing countries, this need was anticipated in the prospectus.[14] A related challenge has been staff changes over the past two years.[15] With the departure of the first Director of Program Area/ Program Leader (DPA/PL), Richard Isnor, in April 2008, followed by an Acting DPA/PL for several months, and the arrival of a new DPA/PL (Naser Faruqui) in August 2008, some changes in management style and program focus has been inevitable. Moreover, three key program officers departed, who had expertise in intellectual property (Rob Robertson), knowledge of STI issues in Latin America and the Caribbean (Gustavo Crespi), and the first ITS PO (Jean Woo) who was closely involved with pre-ITS activities and the development of the PI. In, 09-10, the program operated for more than half of the year with about half the PO FTEs[16] with which it started the year[17]. This slowed down research advising and brokering (including project monitoring), this year. It has also made tracking research findings and outcomes, as the overall development of this report, challenging.

Second communicating what the program does both inside and outside of IDRC has been difficult. Innovation has many interpretations and innovation systems are difficult concepts for many outside the field to understand. Since the arrival of the present Director, ITS has been trying to communicate its goals and objectives, in a clearer fashion, without changing their meaning. They are now being presented as follows:

ITS supports research on STI policies that contribute to economic growth and poverty alleviation in developing countries. This includes mapping the players involved in STI policy, their roles, and linkages; developing science and technology policies and strategies; and identifying the impacts of new and emerging technologies, including helping marginalized groups participate in such debates.

Innovation and Innovation systems are now being presented as follows—with the essentially the same meaning, but somewhat clearer than as presented in the prospectus.

Innovation is doing things in new or better ways to improve people's lives. In order for science and technology to be developed, adapted, and used in ways that create growth and alleviate poverty, a fundamental understanding of the innovation system in any country is critical. An innovation system is essentially composed of the different groups involved in developing, adapting, and using knowledge, including researchers, industry, government, and its citizens, and the interactions between

them. Those interactions depend upon a broad set of social and economic policies, including those concerned with education, industry, intellectual property, and poverty.[18]

Another risk flagged in the prospectus—for ITS to be seen as taking a particular stance on what are often polarized debates on emerging technologies, has not come to fruition. It appears as if stakeholders appreciate that ITS is neutral to emerging technologies such as genetically modified organisms and supports research on both the benefits and risks of such technologies on the poor, to enable developing societies to take informed decisions that take into account a pro-poor perspective.

RESEARCH FINDINGS

This section highlights findings corresponding to the three program objectives. The findings were selected based on quality and originality of the research, relevance to program objectives, and whether they have resulted (or are likely to result) in significant outcomes. The findings are somewhat disparate as they arise mainly from the 7 research projects that have closed and 20 that are coming to an end. A critical mass of well-developed knowledge with depth is not yet apparent as ITS is still a relatively young program.

UNDERSTANDING DEVELOPING COUNTRY INNOVATION SYSTEMS

Under Objective 1, significant research findings relate to building methodologies for analyzing NIS in developing countries, the nature of the NIS in the BRICs countries, how innovation can be enhanced through regional cooperation in LAC, and on IPRs in developing countries.

The suite of projects funded through the 4th competition of the Research on Knowledge Systems (RoKS) made a purposeful effort to develop relevant survey instruments to characterize university-industry linkages (103470)[19]. RoKS awardees revised survey instruments developed in the North to reflect Asian, African and Latin American conditions. This contribution to this emerging field was important because it allowed researchers to compare their studies and reference the work of others. [20]. It also enabled researchers associated with the 4th RoKS competition to publish comparative articles, special journal editions, and several books[21].

The researchers examined how supply of and demand for university research affects the development of UILs and also measured the intensity and the impact of UILs within and across countries and particular sectors. The researchers are now preparing a manuscript[22] that will synthesize the major research outputs from each region that will add to the body of knowledge on UILs in the countries studied. For example, research in Latin America found that while these linkages were the exceptions rather than the rule, their number has been underestimated. The findings refuted conventional wisdom that universities mainly provide consulting services to businesses.[23] In Africa, research documented considerable sectoral variation, from weak university involvement in Nigeria‘s oil industry, to dynamic interactions between universities and biotechnology firms in South Africa. Surveys in Asia found that UILs are not widespread, even in the relatively more advanced countries like South Korea,

but the tendency towards collaboration is increasing. In Asia, researchers concluded that university interaction with industry supplements rather than substitutes firm capabilities. It also found that knowledge transfer from universities to industry is predominant when the receiving firms already have some in-house R&D capacity.[24]

The BRICS project (104227)[25] compared the NIS of Brazil, Russia, India, China and South Africa[26]. The findings revealed the diverse nature of the NIS in these countries. Defence research and development (R&D) is important in China, Russia and to a lesser extent, India[27], while natural resources are important in Russia, South Africa, and Brazil. China focuses on key exports (electronics, shoes, and apparel), while also taking advantage of its large domestic market to promote catching-up[28]. India has advantages not only in software but also in pharmaceuticals, transport equipment, and metallurgy. In infrastructure, Brazil has a clear advantage over the other BRICS countries because of its efforts over the last 30 years in agricultural technology and biological sciences linked to ethanol production. China has pursued a vigorous STI strategy aimed at human resource and infrastructure development. On the other hand, Russia, India and South Africa have witnessed deterioration of their STI infrastructure. Brazil has the best record in terms of income distribution, with a slight improvement as it has grown. Conversely, in China, India, Russia, and South Africa, income distribution has deteriorated as the countries have grown. The project recently held two successful National Innovation Panels in India[29] and Brazil[30] to discuss the findings with researchers and policy-makers. The national panels in China, South Africa and Russia will be held before April 2010.[31] This study is significant because the potential growth of the world's economy for the coming decades will be mostly determined by what happens in the BRICS countries. Given the central role of innovation in their development, the results of this project should inform policies for these emerging economies.

The project on R&D cooperation (104574)[32] in Latin America studied linkages between innovation system actors.[33] While the limited R&D collaboration revealed by the surveys was expected,[34] a number of differences among countries were identified. For instance, in Chile, government support was the key factor for technical cooperation among firms. In Mexico, subsidiaries of multinational companies tend to rely on foreign sources of technology for product innovation and thus cooperate less than local companies in R&D activities. A major obstacle for generating comparable data arose because innovation surveys in the region rely on different methodologies, for example, the Oslo and Bogota Manuals. [35] These findings were developed using a common methodology useful for further comparisons. The project made a number of recommendations that LAC countries might adopt to enhance collaboration within their NIS such as how to improve the collection of micro evidence on innovation. In addition, it suggested that public policies should target key economic sectors such as pharmaceutical, electronic and chemical industries. A policy brief based on these recommendations will be shared with policy-makers and other stakeholders with objective of building capacity in national statistics offices responsible for collecting and processing information on innovation.

The MERCOSUR project (104958)[36] examined and recommended how innovation can be enhanced through regional cooperation. The small size and market of many LAC countries makes it challenging for them to develop dynamic domestic innovation systems. For instance, due to the high initial cost, the study suggested collaboration

on a regional satellite or oceanographic research ship. The project also demonstrated the importance of establishing cooperation in areas where national capacity already exists, such as biotechnology. [37,38] The findings suggests that regional integration in STI should start from the bottom-up , but that strategies to ensure effective and equitable collaboration between countries with different levels of development are essential.

A global project on patents and innovation (104529) showed that African countries (Botswana, Tanzania and Cameroon) have not taken advantage of the provisions available in the Trade-Related Intellectual Property Rights (TRIPs) agreement such patent pooling, and the research exemption, to access patented knowledge for innovation.[39] In general, few indigenous patents exist in these countries because of low awareness of IPRs and few incentives to patent. These countries recommend IPR awareness and education activities in building IPR infrastructure. Although compulsory licensing[40] is one means of making patented knowledge available, it doesn‘t seem as effective to spurring further innovation as patent pooling and can be a disincentive for investment. Most case-study countries use this measure sparingly. In China, patent pooling[41] is extensively used by firms to accelerate innovation, although overseas patents continue to dominate. In contrast, very few patent pools exist in India but they have a high potential in agricultural and health innovations if the right incentives and regulatory measures can be established. The Philippines is beginning to explore patent pooling in specific areas such as biosciences and engineering. Moreover, the research in Brazil has resulted in the formulation of model IPR legislation for an R&D exemption for access to patented knowledge. The model legislation will support fair competition, reinvigorate the old patent system by giving access to foundational knowledge and give greater space for innovation by non-profit and philanthropic institutions. Findings from the IPR research are likely to help developing countries strike a balance between encouraging innovation and investment (through patent protection) and making exemptions for innovations in areas critical to social development). It demonstrates that patent pooling has strong potential for achieving this balance.

DEVELOPMENT OF S& T POLICIES TO ENHANCE INNOVATION SYSTEMS

Under Objective 2, significant research findings relate to STI policies and social development in South East Asia, building R&D capacity in Western China, enhancing innovation in environmental services in South Asia, and improving national STI policies in Panama and Mozambique.

The project on megacities innovation (105180) has found that STI policies in Southeast Asian countries focus primarily on private sector innovation for economic growth. Very little effort has been made to link the NIS to development challenges such as lack of housing and transportation, pollution, climate change, and poverty. Singapore, and to a lesser extent Malaysia, have integrated innovation into their urban development policies, but the focus is still on private-sector development. Thailand has, so far, focused on reforming STI institutions, while the Philippines and Vietnam are working on building innovation system components. But all five countries are focused on STI for economic growth. These findings are significant because of their potential use to convince STI agencies that a more development-oriented STI agenda should be considered.

The project on innovations in western China (103933)[42] funded jointly by ITS and China's Ministry of Science and Technology (MOST)[43] concluded that the low capacity for technological innovation in China's West is primarily due to overdependence on imported technology, low R&D investment and limited cooperation among enterprises. The project recommends developing policies to enhance the R&D capacity of manufacturing enterprises and paying more attention to the role of local farmers in the region's agricultural innovation system.[44] Other recommendations include enhancing R&D capacity of seed enterprises and protecting local seed companies from foreign competition. The project findings on the seed industry were carried by popular Chinese news media such as Xinhua News Agency Outlook Weekly, China Central TV (CCTV) and 21st Century Business Herald, resulting in a great deal of public attention. The project results were also presented at a forum on seed technology and food security organized by the Ministry of Agriculture, Ministry of Science and Technology, and Hainan Provincial Government (January 2010). The decision by MOST to allocate $500,000 to the project signifies the importance it attaches to this research.

Two projects in South Asia and South East Asia showed that access to knowledge and technology among relevant actors are important for innovation in the delivery of public services such as solid waste management and sanitary and phytosanitary services. In South Asia, the project on solid waste management services (104356) found that knowledge sharing, linking and learning made local municipal waste management officials more innovative, even without any additional infrastructure or capital.[45] In SE Asia, the project on sanitary and phytosanitary standards (SPS) (103929) found that limited interactions occurred between government regulatory agencies responsible for SPS[46] and key players such as producers, farmers, and exporters.[47] In most countries, these agencies have limited capacity for pest and disease diagnosis, surveillance, and mitigation. As a consequence, many of these countries are not able to meet the World Trade Organization (WTO) standards governing market access for agricultural produce. These projects show that access to technical knowledge and building of learning capacity through collaboration can lead to innovation in public services.

A review of Nicaragua's NIS (105164)[48] revealed that in addition to a weak institutional framework, the major organizations responsible for innovation lack the requisite capacities. Despite substantial donor aid received over the last two decades to support activities such as elaboration of national and sector-specific plans, long-term action plans are missing.[49]

In Panama, ITS research found that although the country created the foundation of a modern institutional framework for STI, it suffered from several deficiencies. For example, the law that created the National Agency for STI (SENACYT) made it the only body responsible for STI policy. This isolated SENACYT from other ministries and agencies. SENACYT was made responsible for STI policy design, implementation, and evaluation. ITS's study recommended the establishment of a multi-stakeholder National Research Council responsible for monitoring and evaluation of innovation activities and a National Research Fund for STI implementation following Uruguay's model. The study concluded that SENACYT's mandate should focus on STI policy planning, design, and program formulation. The study also recommended that the board of SENACYT should include representatives

of other Ministries and agencies, following the OECD's recommendation for a —whole government" approach to innovation policy.

In Africa, ITS support (103350) enabled Mozambique's Ministry of S&T (MCT) elaborate a STI Strategy.[50,51] The Mozambique study concluded that despite government efforts to improve higher education institutions and develop human capital, improvements were required in the areas of STI financing and governance. Foreign financing of individual STI organizations independent of any government coordination hampered efforts to establish transparent governance, design long-term policies and chart future institutional development. The report recommended better coordination and knowledge sharing within the MCT, and between MCT and other government agencies.

IMPACTS OF EMERGING TECHNOLOGIES ON DEVELOPING COUNTRY COMMUNITIES

Under Objective 3, significant research findings relate to the benefits and risks of several GM crops in South East Asia and LAC, more specifically on the benefits and risks of BT cotton in China, and on critical questions to be addressed to inform the governance of nanotechnology in India.

The project on biosafety policy (103577)[52,53] indicated that GM crops (insect resistant maize and herbicide-tolerant soybean and Bt cotton) can be economically advantageous for smallholder farmers. However, the results are not categorical, and political, educational, and economic limitations constrain wider use. Moreover, the next generation of studies will need to look more critically at impacts on labour, health, gender, and the environment. In the Philippines, the study found few observable differences in social status or gender relations between farm families who grow Bt maize hybrids and those who grow non-Bt maize hybrids. Growing herbicide-tolerant soybeans appears to reduce family labour requirements for soybean production amongst small-scale growers in Bolivia, freeing time for other activities, but the government's opposition to GM crops impedes wider use. In Honduras, the research showed that the performance of GM varieties is constrained by inadequate information for farmers, and up-front costs prohibit investment in Bt maize by growers with less than 2 hectares. In Colombia, the credit worthiness and other features of local producer organizations are major determinants of Bt cotton adoption. The project was successful in improving the knowledge base critical to informing GM crop policy and identifying issues that require further study.

In China, the project on biosafety management (103783) confirmed the effectiveness of GM (*Bt*) cotton in reducing yield losses due to bollworms in the major cotton growing provinces of Hebei, Henan and Shandong.[54,55,56,57] The study also concludes that adoption of *Bt* cotton by farmers has resulted in an overall reduction of pesticide use by about 60% due to falling bollworm populations. However, due to lack of information, some farmers continue to overuse pesticides even after adopting *Bt* cotton. With better farmer training and access to extension services, pesticide misuse could be significantly reduced. The research also found that the private sector has been a major contributor to the rapid spread of *Bt* cotton among small scale farmers. However, the rapid increase in the number of seed companies has also resulted in the proliferation of unauthorized seeds of varying qualities. In turn, the seed market has become so complex that farmers are unable to distinguish between genuine and illegal seeds. More than 40% of farmers have resorted to

saving the seeds from one planting season for use in the next. This has not only discouraged the private sector from developing new seed varieties, but has also slowed down adoption of new varieties by farmers. The research concluded that improving the IPR environment could increase the commercialization of new varieties and enhance the benefits derived by farmers from the technology. The research resulted in a number of policy recommendations to the Ministry of Agriculture and the central government regarding reform of the country's agricultural input market, enforcement of biosafety regulations and capacity building.

In India, the project on nanotechnology governance (104068) demonstrates the enormous potential of nanotechnology[58] in socially important sectors such as water, energy and agriculture. Most of the research is dominated by the public sector—the Indian government spends over US $6 million a year. Nevertheless, private sector research and development in nanotechnology is rapidly growing, for instance, the development of water filters using nanomaterials is being pursued by several firms. Existing biosafety and environmental regulations currently govern nanotechnology. None of the companies has performed any toxicology tests, because there is no regulation that they should do so, despite the fact that it is unclear whether nanoparticles pose serious risks to health and the environment. The behaviour and impacts of nanoparticles will likely vary depending upon their size, shape, and chemistry. The study formulated several key questions for further research including the fate of nanoparticles inside the body; the type of immune response they elicit, and whether their concentration affects their activity inside the body. The project concluded that there is a critical need for a database on toxicity and a regulatory framework for nanomaterials use, handling and disposal. A *White Paper* on nanotechnology is ready to be presented officially at the project closing event in April 2010.[59]

PROGRAM OUTCOMES

This section highlights outcomes in five key areas— STI policies, impacts of transformative technologies, dissemination of STI information, capacity building, and networks. In some cases, outcomes are strong and the evidence for them is relatively clear, although in almost all cases, follow up by the External Reviewers to verify outcomes will be useful, especially as clear baselines were not established at the outset. In other cases, outcomes are only emerging, because the program is relatively new, or it is difficult to prove the outcome. Nevertheless, in order to illustrate what the program might achieve, a few emerging outcomes, with appropriate qualifiers, are included.

1. ITS PROJECTS HAVE CONTRIBUTED TO POLICY INFLUENCE

For many developing countries and institutions, behavioural norms and laws, as well as policies in support of innovation are absent, unlinked or ineffective.[60] ITS research has influenced STI policies and strategies in several developing countries. The ultimate outcome, for which evidence is not yet available, is for these new or revised policies to result in an enhanced functioning of innovation systems. Contributions to STI policy influence can be divided into two broad categories—

policies and strategies derived from national STI reviews, and policy recommendations from specific ITS-supported projects.

I) POLICIES BASED ON STI POLICY REVIEWS:

Science and technology can be important drivers for social and economic development as long as they are accompanied by supportive strategies and policies. Effective strategies help identify and prioritize sectoral priorities for STI investment, such as ICTs or biotechnology. Enabling STI policies are many and cross-cutting, and include those related to education, research and development, trade, industrial policy, intellectual property rights, and human resource development.

In essence, effective STI policies help establish a framework for ensuring that research, including IDRC supported research, contributes to national goals and results in social and economic development.

Since 1988, IDRC has funded the development and refinement of STI policies and strategies in 12 countries[61], including Colombia (1988)[62], South Africa (1992)[63], China (1995)[64], Vietnam (1997[65], 2010[66]), Chile (1998[67], 2008[68]), Jordan (2000)[69], Mozambique (2005)[70], Honduras (2006)[71], Sri Lanka (2007)[72], Nicaragua (2008)[73], Panama (2009)[74], and the Philippines (2009)[75]. Half of these reviews were funded under ITS totaling $1.1 million.

These studies are called STI reviews, and assess NIS focusing primarily on the role of government. Prior to the mid eighties, when the concept of innovation systems was little known, they were described as Science & Technology (S&T) reviews, although the process of innovation—turning knowledge into value, was always implicitly included.

Only one comprehensive evaluation of the impacts of IDRC's STI reviews has been carried out— by Voyer, in 2002[76], suggesting it may be time to commission a tracer study. Based on the Voyer evaluation, technical reports, and further interactions with partners through second phase projects, the impacts can be grouped into three stages on the same continuum.

The first impact is the development or refinement of national STI policies and strategies and subsequent adoption by governments. This may not seem a significant enduring impact, given that this result is explicitly sought by this group of projects. However, as forty years of IDRC-supported research have demonstrated, acceptance and adoption of new policies, especially national level policies, by developing country governments, is difficult to achieve. Yet in eight of the 12 projects supported, including in South Africa, Chile, China, Vietnam, during the pre-ITS period, and in Mozambique, Panama, Nicaragua, and Sri Lanka, under ITS, governments adopted the new or refined S&T policy. In Mozambique, the STI strategy was embedded within the government's poverty reduction strategy.

The second impact is the establishment of new organizations or the restructuring of existing ones, in order to make national innovation systems more effective. Weak institutions and unclear, fragmented, and overlapping mandates are amongst the most enduring challenges in developing countries, so this is an important result that followed earlier pre-ITS reviews, in South Africa, Chile, and Vietnam. For the current

phase, in Panama, the government is implementing the institutional restructuring cited earlier, with the help of IDRC. Significantly, the recently-elected government is implementing the study commissioned by the previous government. [77]

The third impact on the continuum is for new or reformed STI organizations to develop and implement programs aimed at producing, sharing, and using STI for social and economic development. The case of Mozambique is instructive. The Ministry of S&T (MCT) has been implementing virtually all of the STI review recommendations outlined in the previous section, and in some cases, has gone beyond them. For instance, MCT launched a national innovation program squarely addressed to the needs of the poor. The program has identified 66 innovators in the country and 78 innovations, including a manual irrigation pump, a low-cost maize mill and a cashew processing machine. The program helped the innovators develop their prototypes and is now helping them produce and commercialize these pro-poor technologies. A second initiative is a technology and business incubator. The program has led to the establishment of new entrepreneurs, companies, and jobs. Mozambique is now linking the technology and business incubator with a new science and technology park and has approved tax incentives to encourage new knowledge-based companies to set-up shop. IDRC cannot take credit for all of these initiatives, and many are funded by other organizations such as CIDA and the World Bank. But the government itself recently indicated that these initiatives were largely influenced by the first IDRC-supported research project on STI policy for Mozambique[78]. And ITS is continuing to support the government by helping with the implementation of its new Council for Scientific and Industry Research.

Although the above results cannot be wholly attributed to the IDRC-supported STI reviews, there is little doubt that they made significant contributions. Not only have the projects resulted in deep impacts in countries such as Mozambique or Panama, but in addition their influence has not been restricted to the countries where they were undertaken. Because the STI reviews generally receive favorable attention from governments upon completion of a study, IDRC often receives requests from neighboring countries. For instance, in LAC, at least one official STI review request is received every year.

The success of the projects can be attributed, in part, to the fact that they are demand-driven, with that demand coming from high levels of government. For example, the Chilean review started from a request from Chilean President, Eduardo Frei, to Canada‘s Prime Minister, Jean Chrétien, during an Asia Pacific Economic Cooperation meeting. This high level of interaction often facilitates the fieldwork.

Policy influence was generally more pronounced in countries where the governments were committed to strengthening their innovation systems or where structural changes to these systems were already underway, for example in South Africa and China. In the case of Mozambique, the review was a precondition for donor support to the Ministry of S&T.

While many of the projects have achieved significant policy influence, impacts in terms of building local capacity are less clear. In many developing countries, local capacities to develop STI policies remain weak. So it has been difficult to find local organizations to conduct the review. In some cases, reviews teams have included specialists from neighboring countries, but in many cases because the reviews are

often linked to competitiveness, many governments do not trust specialists from neighboring countries. As a result, in at least half the cases, the reviews have been carried out by international specialists, working either for themselves or for organizations such as the Economic Commission for Latin America and the Caribbean (CEPAL) or UNESCO.

Where possible, these high capacity partners have worked to mentor local organizations, including in the cases of Mozambique, Honduras, and Nicaragua. For instance, in the latter case, researchers are working with the S&T council to prepare the STI plan but also to build its STI capacity.

Another potential area of weakness is determining what the level of innovation in a country is and whether or not the STI policy has actually led to economic growth or poverty alleviation. Amongst other things, this question cannot be answered without developing and tracking STI indicators. Several of the projects, including Mozambique and Nicaragua, include a component to build the capacity of STI government staff to develop and monitor such indicators.

II) POLICIES RECOMMENDATIONS FROM SELECTED ITS PROJECTS:

Policy influence has also come from individual projects or groups of projects supported by ITS. For example, the biosafety management project (103783) resulted in a number of policy recommendations (captured in 3 policy briefs)[79] to China's Ministry of Agriculture and the Central Government on the country's agricultural biotechnology development, including the recently initiated National Special Program for the Development of Transgenic Plant and Animal Breeding.[80] First, the project called for continued investment in agricultural biotechnology to help small Chinese farmers reap its benefits, but recommended reforming the country's seed and pesticide markets. Second, the project recommended stronger enforcement of biosafety regulations at local and national levels. Third, it suggested use of public extension and research services to build farmer and dealer capacity to use the technology effectively and safely.[81] A policy brief based on these recommendations contributed to a major decision by the State Council of China to invest substantial funds on GM technology research, including studies on biotechnology impact, policy and regulation.[82] Another policy brief on seed industry reform[83] also received considerable attention of policy-makers. As a result of this brief, the Ministry of Agriculture issued a national document to enhance seed industry management and market inspection. Other recommendations on improving the cotton seed market system including a more transparent government procurement system, enhanced quality inspection and monitoring systems, and market regulation have been incorporated into government policy.[84] It is unlikely that the project findings alone led to these decisions. Other factors such as the Centre for Chinese Agricultural Policy's reputation and good relationship with the relevant government ministries likely also played a role.

The project on biosafety policy (103577) supported research on the impacts of GM crops on smallholder farmers and had policy impacts at both national and international levels.[85] In Colombia, case study results and capacity strengthening efforts increased the negotiation power of the Colombian cotton producers

association (CONALGODON) with Monsanto regarding prices and access to information and knowledge. This induced an improvement in product stewardship efforts by Monsanto.[86] Furthermore, the Colombia report was instrumental in strengthening the biosafety regulations being implemented by the Colombian Agricultural Institute.[87] In both Honduras and Bolivia, the project team could not conduct any policy outreach activities due to the unstable political situation in these countries in 2008-9. But with the situation starting to improve, the team plans to resume their studies in collaboration with local partners. In the Philippines, the country's case study on GM corn helped the government agency responsible for biosafety appreciate the necessity of socio-economic assessments in policy decisions. For example, the National Biosafety Committee of the Philippines (NBCP) welcomed the case study results as an important contribution to the implementation of the country's biosafety policy.[88,89] However, the NBCP recommended that the GM corn case studies should be continued for five years. A recent reorganization of the NBCP has brought a social scientist into the committee.[90] Similar appreciation of the study came from other research organizations such as the Philippine Rice Research Institute (PhilRice). The project partners at the University of the Philippines-Los Baños and at Ateneo de Manila University continue to be consulted by the NBCP.

Similarly, the project on plant health and safety standards (103929) made the following recommendations:[91,92]

a) governments in SE Asia to foster stronger linkages among all the key players such as producers, farmers, exporters and importers and research organizations. This recommendation is already being implemented by Malaysia, Cambodia, and Lao PDR.[93,94,95]

b) increased government support to National Plant Protection Organizations (NPPOs). Vietnam and the Philippines partners who participated in the project are actively lobbying their respective governments for more financial support for SPS activities.

c) translate the standards into local languages to make them comprehensible by all stakeholders. Indonesia, Thailand and Vietnam have begun translating the key standards.

d) establish collaborative linkages to enable countries with limited capacities to have better access to information, knowledge and facilities. The project concluded that the formation of a regional network would be an efficient way of enhancing in-country and cross-border cooperation in order to improve SPS services and promote regional and global trade in agricultural produce.[96] As a follow up to this recommendation, CAB International has secured donor support to establish an Association of Southeast Asian Nations (ASEAN-wide Network that will provide SPS services such as pre-harvest measures, diagnosis and mitigation measures).

This outcome is significant because increased trade in agricultural produce is critical not only to food security but also to economic growth in the region. Agriculture serves as a livelihood for 65% of the region's population and 80% of its poor.

In China, a policy brief to the government based on the findings of the project on *Innovation Systems for Inclusive Development* (105357) was recently approved by Chinese Premier, Hu Jintao.[97] He encouraged the partners to continue their work on pro-poor approaches to Agribiotech development and diffusion. The policy brief urged the government to provide technical and financial aid to enable the poor

farmers gain access to important technologies such as high-yielding seeds and soil fertility improvement technologies.[98]

The project on Small and medium enterprises (SMEs) innovation (104044) has helped policy-makers in China's Zhejiang, Fujian and Shandong provinces take a broader view of innovation encompassing both technological and non-technological aspects. The project has resulted in several recommendations (captured in 10 policy briefs) addressing the factors responsible for poor innovation performance of SMEs, including insufficient R&D expenditures, weak university-industry linkages, and weak adoption of advanced technologies. Some of these recommendations have been adopted by policy-makers at local and state government levels. For example, the policy recommendation on indigenous innovation was accepted by the Bureau of S&T of the Ministry of Education Zhejiang province and subsequently shared with state S&T officials.[99]

Several on-going ITS projects show promising signs for future policy-influence. For example, the BRICS project (104227) continues to get the attention of key policy-makers in India and Brazil where National Innovation Panels have been held. These panels were attended by high level policy-makers such as the Indian State Minister for External Affairs and the Brazilian Vice–Minister for S&T.[100] In LAC, the MERCOSUR project (104958), initiated by the MERCOSUR Council Secretary General, is expected to result in policy recommendations on how to design, manage and implement an Innovation Program Framework.

The policy outcomes of the joint ITS-MOST project on innovation in western China (103933) will become more apparent as the project nears completion. Nevertheless, some of the project findings are already being used to formulate the 12th National Five Year S&T Plan as well as the new industrial plans in Shaanxi and Ningxia provinces.[101] The megacities project (105180)[102] is beginning to establish linkages with policy-making bodies. In Thailand, the Secretary General of National STI Policy Office has suggested that the results of Technology Foresight activities be included in drafting the country's 10-year STI Master Plan due in late 2010.[103]

2. ITS PROJECTS HAVE CONTRIBUTED TO A BETTER UNDERSTANDING OF THE IMPACTS OF EMERGING TECHNOLOGIES ON DEVELOPING COUNTRY COMMUNITIES

Emerging technologies, such as biotechnology and nanotechnology, have considerable potential to improve health, food security and the environment of the world's poor. But their development, adoption, and use also present socio-economic risks. ITS projects are contributing to a better understanding of the socio-economic impacts of these technologies by researchers, communities, and policy-makers by developing methods for assessing impacts and facilitating dialogue about their use amongst different groups.

A sound methodology is essential for assessing the socio-economic impacts associated with new technologies. On this basis, the project on biosafety policy (103577) supported the development of a set of ~~b~~best practices" for assessing the socio-economic impacts of GM crop varieties on smallholder agriculture in developing countries.[104] The methodology was subsequently tested in the Philippines, Honduras, Bolivia, Colombia, China, India, and South Africa.[105] The same methodology is currently being used to assess the impacts associated with

insect resistant Bt cotton in Uganda, Ghana and Malawi.[106] Additionally, the Convention for Biodiversity adopted the methodology for use in a decision support "tool kit" [107] for developing countries,[108] although recent correspondence from the partner indicates that little progress has been made towards developing it.

The policies governing new technologies should be borne out of dialogues among researchers, policy-makers, civil society groups and other stakeholders. Projects that aimed at advancing dialogue about the applications of transformative technologies in the developing world are highlighted below.

The project on the *Impacts of GMOs on smallholder farmers in developing countries*[109] (103060) identified the impact of IPRs on seed systems in Uganda, Kenya and Tanzania, and proposed strategies for better access to improved crops for smallholder farmers in East Africa. The main outcome was the development of a publicly accessible, Wiki-based website (*Seed Systems in East Africa: Impacts of IPRs and Related Laws, Regulations and Policies on Smallholder Farmers*)[110] that provides concise information gathered during the project and can be continuously updated by key stakeholders. The project also supported the French version of *Food Security and Ag-Biotech* (FS-AgBiotech) News,[111] Meridian Institute's free daily publication, which provides balanced and succinct news and analysis about global developments related to agricultural biotechnology and food security in developing countries. Combined, the English and French versions of the news have over 2,000 email subscribers from over 80 countries. As a result, the project has benefited stakeholders in the region working on crop improvement and seed distribution by increasing information sharing and dialogue amongst them.[112]

The project on nanotechnology governance (104068)[113] was the first ever comprehensive assessment of nanotechnology governance in India.[114] Through various publications, workshops, seminars and lectures, the project helped raise awareness about nanotechnology policy and governance among various stakeholders. As noted in the previous section, this project has already organized several national dialogues based on key project findings, for example inadequate understanding of the potential risks of nanotechnology, weak regulatory framework to address the multi-dimensional risks of the technology and the potential opportunities for technology development and diffusion.[115,116] The project findings are being compiled into a *white paper* which will be submitted to the government of India in the near future. The project has led to a larger South Asian project that brings together the Pakistan National Commission for Nanotechnology, the Sri Lankan National Science Foundation and TERI (India) in collaborative research on risk assessment, foresight analysis, technology forecasting.[117]

3. ITS PROJECTS HAVE IMPROVED SHARING OF STI INFORMATION, KNOWLEDGE, AND EXPERIENCE

As noted in the Research Findings section, STI is a relatively new field in developing countries. ITS activities have contributed to making knowledge accessible to researchers, policy-makers, and communities, in different formats, including influential literature, websites, and workshops. The ultimate intended outcome is for this knowledge to improve understanding of how STI can be used for sustainable and equitable development in developing countries. While some of the shared knowledge has stimulated public debate and helped policy-makers make decisions,

it is premature to state that ITS has improved understanding. This outcome is distinguished from the following one in that the examples given are not primarily about building capacity to share knowledge.

Knowledge from ITS projects has been published in influential STI journals, as well as books and policy briefs.[118]. For example, 13 articles based on the findings of the 4th RoKS competition have been published in *Science and Public Policy*.[119] Findings from the project on biosafety policy (103577) have been published in AgBioForum, International Journal of Biotechnology and in *Food Policy Review No. 10.*[120] An article based on the science journalism project (103349) appeared in *Nature*[121] and it was cited in an editorial in *Science.*[122] Similarly, an Article in the *Asian Journal of Technology* [123] was supported by the consultancy project (105104).[124] The book, "*The Future Control of Food: A Guide to International Negotiations and Rules on Intellectual Property, Biodiversity and Food Security*", based on the project on WTO negotiations (103311)[125] examines the trade-related aspects of food vis-à-vis IPRs. It clarifies legal jargon for both the lay person and country trade negotiators.[126] It was awarded the *Derek Cooper Award for Campaigning and Investigative Food Writing.*[127] Other books supported by ITS include *"Fuelling economic growth"* [128] (Pre-ITS 101678) and *Nurturing the Enterprising BOP*.[129] ITS projects also produced a number of policy briefs some of which have influenced policy, for example, in the biosafety management project 103783.[130] Most of these publications are still new and so their impacts, as measured by the number of citations, are low. For example, a recent analysis of the publications from project 103783 found that despite their high quality, the citations are few but will likely increase over time.[131]

Workshops can be a very effective means to share knowledge and improve understanding, because of their interactive nature. ITS projects have supported several workshops to facilitate STI knowledge sharing among researchers, policy-makers and other stakeholders. Several of these activities have led to further knowledge production. The Conference of Science Journalists (102484) co-sponsored by DFiD, led to the science journalism project. The workshop on *China-India Innovation Experiences* resulted in 3 projects (104356, 105357 and 105170) involving research teams from China and India. Similarly, the workshop on *Integrated Policies for Bio-Innovations in Agriculture and Health in Asia* (104041) organized with the Rockefeller Foundation led to the *Bio-innovation* project (104530).[132] In LAC, a regional workshop (105162) led to the project on *Technologies for Social Inclusion and Public Policies in Latin America* (105560).[133] The workshop on *Institutional Model for the Caribbean Industrial and Technological Services Limited* (105481)" helped design an appropriate model for the Caribbean Industrial and Technological Services Limited (CITSL).[134] ITS has also enabled partners to participate in international conferences such as GLOBELICS and WAITRO, and now they are starting to influence its agenda.[135,136] For example, the 4th RoKS awardees used the Mexico and Dakar GLOBELICS conferences to present their research findings and to develop a book outline for research in LAC, Africa and Asia. The involvement of ITS partners in organizing the GLOBELICS conference has increased. For example, six ITS partners were recently named to the organizing committee of GLOBELICS 2010[137]. Other partners also participated in organizing the GLOBELICS conference in Dakar.[138] During GLOBELICS 2010, the partners of the project on S&T policy in Sri Lanka (104357) will organize a special symposium on inequality and innovation.

Aside from publications and meetings, ITS projects (103577,[139] 104904,[140] 105180,[141] 104530,[142] and 104356[143]) have enabled the development of interactive websites to share information, knowledge and experiences. For example, the iBoP Asia project (104904) website (http://www.ibop-asia.net/)[144] is used to announce calls for proposals makes available project publications and provides links to other relevant resources. The website has averaged 73,000 hits/month since April 2009, demonstrating interest in the project in the region and beyond. Google lists this webpage first for an iBoP research query. The number of respondents to the project's call for proposals increased from 51 in 2008 to 123 in 2009. The portal was used to host an online forum on climate change adaptation in 2009 and for *Innovation Talk, a* discussion series organized in collaboration with the Ateneo Innovation Center. The partners have also used the website to build partnerships with other organizations in the region and beyond.[145]

The biosafety policy project (103577) developed an interactive, searchable web-based bibliography on the Impacts of Genetically Engineered Crops in Developing Countries.[146] It is being used by developing country researchers with limited on-line access to journals. By early 2010, the database included 267 articles, 130 of which have links to the full text. The bibliography (bEcon) is being widely used. Between June 1 and August 25, 2008 the number of pageviews was 2,120, and bEcon became the most visited page after the IFPRI main homepage.[147] A CD-ROM with the same content as the website is produced annually for researchers with limited access to the internet. By August 2009, about 450 CDs had been distributed to 38 different organizations. Similarly, the biosafety management project (103783) has helped establish a database on GM cotton production and biosafety management in China.[148] This includes the varieties approved/rejected for either environmental release or pre-production trials.

To encourage informed public debate that influences policy, ITS provides core support to SciDev.Net (SciDev)[149] to report on issues at the intersection of S&T and development (SciDev phase III, 103104, SciDev Phase IV, 105598). World-leading journals like *Nature* and *Science* give SciDev free access to selected articles each week. ITS-supported projects have also been carried by SciDev, for example nanotechnology governance in India (104068)[150] and socially-inclusive innovations in China and India (105357). SciDev is an influential modality for sharing STI knowledge. According to a 2009 User Survey, SciDev.Net has helped 70% of media respondents improve their skills in communicating science thus helping policy-makers arrive at decisions on critical issues.[151] In addition, 95% of respondents think the SciDev.Net website is excellent or good and 84% would recommend the site to others.[152]

ITS's third (2009) core-grant (105598) is helping SciDev decentralize by supporting activities for its regional coordinators, enhancing French language content, and supporting three young Southern journalists to do their internships at SciDev. A January 2010 survey indicates a 47% increase in readership of French content by users from France, Francophone Africa and Canada, since January 2009. SciDev readership in Francophone Africa has risen tremendously.[153] The partner attributes these developments to ITS support.

4. ITS PROJECTS HAVE BUILT THE CAPACITY FOR PRODUCTION, SHARING AND USE OF STI KNOWLEDGE

Building the capacity to produce, share, and use STI is critical for social and economic development. ITS projects have contributed to building the capacity of different stakeholders to generate (researchers), translate and disseminate (journalists), and use (farmers, policy-makers, and civil society) STI knowledge. Examples of outcomes under each category are provided below.

Projects (103783,[154] 103577,[155] 104043,[156] 103470-013, 104958,[157]) have helped developing country partners build research capacity by embedding higher degree training (at MSc and PhD levels) for young researchers into projects.[158] For example, the biosafety management project (103873) trained 3 PhDs and 1 MSc student. Some of these students now occupy responsible positions in their organizations.[159] ITS has also built capacity of Interns and professional development awardees[160] as part of the IDRC Training and Awards Program. These programs helped young talent beginning their careers in innovation systems research to gain experience in a range of project and program activities and conduct research on a specific theme including field experience.

ITS also helped less experienced researchers acquire new research skills through collaboration with established ones. For example, the biosafety policy project (103577) helped researchers build capacity for socio-economic impact assessment.[161] The Honduran case study enabled Zamorano University to enhance its capacity for policy analysis and impact assessment. The increased capacity is expected to benefit over 800 students from 17 countries in Latin America and beyond.[162] In Bolivia, the project strengthened the capacity of *Asociación de Productores de Oleáginosas y Trigo* (ANAPO) to collect data and conduct socio-economic impact analysis. A group of 10 young professionals were trained in survey methods and awarded certificates of appreciation by ANAPO.[163] The genomics innovation project (104043) enabled joint learning on how research and innovation capacity in genomics/ health biotechnology could be extended to other developing countries through collaboration. The project involved researchers from Brazil, China, Cuba, Egypt, India, South Africa and Canada.[164] Similarly, the project on Burkina Faso innovation systems (104872) introduced local researchers to the concept of innovation systems for the first time. As a result of this training, at their own initiative, the Burkina researchers further improved their skills at the University of Maastricht.

Sharing existing knowledge is as important as producing new knowledge. Science journalism helps translate research so that it can be better understood and used by the public and policy-makers. For this reason, ITS has supported the training of science journalists. The goal is to build the capacity of southern journalists, who understand local contexts, to frame stories on STI to enhance public debate and influence policy

For instance, in the science journalism project (103349), experienced science journalists from all over the world mentored 60 young science journalists in 35 countries in the Middle East and Africa. There are now active networks of science journalists in several countries, including Jordan, Morocco, and Sudan, who collaborate together on science-related stories, whose articles are in demand from local editors, and who are trusted by local scientists.[165] As a result of the science journalism project, 20 mentees have been awarded more airtime or printed space to report on health, the environment, and scientific issues, 14 mentees are now in

charge of science beats, and two others teach science journalism at universities. SciDev, which initially did not have enough high-capacity southern journalists, employs many of the freelance journalists that emerged from the project. In fact, the most discussed story ever published on SciDev, *Sickle cell drug mired in controversy* [166] was co-written by a mentee, and his mentor.[167] ITS will now support Phase II of the project focusing on building the capacity of the project's 3 regional coordinators as well as Southern science journalism associations, following the recommendations of an External Evaluation.[168]

A preliminary outcome from project 104045 is that the Academie Nationale des Sciences et Techniques du Senegal (ANSTS) has created the Association of the Scientific Journalists of Senegal (AJSS),[169] and is providing on-going intellectual and financial support.

ITS projects have also been instrumental in building the capacity of innovation system actors such as farmers, policy-makers, NGOs, and science academies to use STI knowledge. In China, the biosafety management project (103783) helped build the capacity of cotton growers in Hebei, Shandong and Henan provinces in the proper use of GM cotton.[170] The project on SMEs innovation (104044) trained over 300 SME managers as well as other practitioners in Total Innovation Management (TIM)[171] to leverage innovation in China's Zhejiang, Fujian, and Shandong provinces.[172] Additionally, the project strengthened the capacity of policy-makers by facilitating interaction and knowledge–sharing between them and university researchers, industry managers and government officials. According to a senior officer with the Bureau of SMEs in Zhejiang province, the project has ~~p~~provided the Bureau with a new vision for managing SMEs".[173] Similarly, the project on sanitary and phytosanitary standards (103929) has contributed to capacity building in these services in SE Asia by taking a holistic approach that targets all actors in the value chain and goes beyond upgrading technical skills for pest/disease diagnosis and surveillance.[174] The project has also built the capacity for decision-making by introducing policy-makers to WTO's International Standards for Phytosanitary Measures (ISPMs) related to market access.

The project on national development research in Honduras (102560)[175] has helped build the research management capacity of FOPPRIDHE, a national federation of NGOs in Honduras. However, the expectation that the expertise gleaned from the project would be transferred to the country's National Research Council (COHCIT) was not realized mainly due to weak linkages between the two organizations. Some of the water management and renewable energy research supported under this grant helped build alliances among researchers and Municipalities and NGOS such as Coffee Business Associations.[176] Lessons learned from this project, such as the importance of working directly with a key policy actor such as COHCIT, proved valuable in subsequent ITS projects in the region. For example, project 105164 on building institutional capacity to develop and use indicators for monitoring of S&T activities in Nicaragua[177] was implemented directly with the Nicaraguan Council of S&T (CONICYT).[178]

The project on innovation policy in LAC (105167)[179] has built the capacity of National Research Councils (NRCs) to evaluate STI policies. The training, organized by UNU-MERIT and Uruguay's National Innovation Agency (ANII), was attended by 55 officers from NRCs in Argentina, Botswana, Brazil, Colombia, Costa Rica, Cuba, El

Salvador, Guatemala, Honduras, Jamaica, Panama, Peru, Venezuela and Uruguay. The participants expressed great satisfaction with the training course, which enabled them to network and identify research opportunities. As a consequence, ITS supported a consultation on data sources for STI policies, the results of which were presented at a regional workshop on indicators for policy design and evaluation in September 2009.[180] Following the training, course participants and trainers from government agencies, universities, international organizations and NGOs in Uruguay, Chile, Argentina and Colombia initiated research on the needs of policy-makers regarding indicators for policy design and evaluation.[181] Some recommendations from this project are part of a new loan program by Inter-American Development Bank to the Colombia Research Council.[182] Similarly, the Economic Commission for Latin America & the Caribbean (ECLAC) project (104574) has built the capacity for innovation analysis among the organization‘s staff and other researchers. The project has also strengthened the linkages between researchers and those responsible for innovation surveys. Young researchers have participated in the project‘s conferences and improved their research skills. The project has succeeded in demonstrating the potential value of regional level data to policy-makers.[183]

Within the framework of African Science Academy Development Initiative (ASADI), the National Academy of Senegal project (104045)[184] hopes to strengthen the capacity of Academie Nationale des Sciences et Techniques du SENEGAL (ANSTS) to provide informed, impartial, and independent advice to the public, civil society, and policy-makers on STI issues. This project has had some limited success. The Academy has built its capacity in financial management, resource mobilization, independent expert panels, and working with the media, but more needs to be done.[185]

The project on STI indicators in Africa (104753) is starting to build the capacity of researchers and policy-makers from Mozambique, South Africa and Rwanda to gather, analyze and use information necessary for developing STI indicators.[186] The project is already raising awareness about critical issues in the development and application of such indicators. Three books are being prepared for use as teaching tools. Similarly, project 104355 has demonstrated practical methods for developing indices for measuring rural innovation in Bhutan, Sri Lanka, Bangladesh, Nepal, Pakistan and India.[187] The development of indicators that benchmark small, local [188] innovations are aimed at encouraging STI policy-makers to embrace a broader concept of innovation.

5. ITS PROJECTS HAVE BUILT PARTNERSHIPS AND STRENGTHENED REGIONAL AND INTERNATIONAL NETWORKS OF RESEARCHERS AND POLICY-MAKERS

IDRC-supported research has long illustrated the importance of research networks for more effective research, policy influence, and capacity building. ITS support has helped nurture and in some cases, created STI research networks in developing countries.

Three small grants competitions organized under RoKS between 2001 and 2005 and the 4th competition (103470)[189] launched in 2006 helped create networks of developing researchers that work, share knowledge and learn together. As well as enabling South-South and North-South collaboration, these projects have networked

young and talented researchers.[190] In a few cases, the RoKS recipients developed substantive phase two projects that received funding from IDRC and other donors, suggesting the network helped build capacity. For example, the project on knowledge networks for supporting international sanitary and phytosanitary standards in Asia (103929)[191] resulted from an earlier RoKS project that analyzed similar networks in Africa and the Caribbean countries.[192] The partners of the RoKS project *Understanding policy processes in biotech and biosafety measures in Thailand and China* (102334) are currently implementing the regional project on bio-innovation (104530). Similarly, a second RoKS competition (101678-004)[193] awardee in South Asia went on to develop a major project on *Knowledge to innovation in solid waste management* in Sri Lanka (project 104356). An awardee of the 4th RoKS competition project (103470-09) recently received ~~"R~~esearcher of the Year" recognition and was appointed to the editorial board of the *African Journal of STI and Development* and *Innovation and Development,* The partner attributes this recognition of enhanced capacity to the RoKS project.[194]

Other small grants projects that successfully created research networks include *Bio-innovation for poverty alleviation in Asia* (104530),[195] *Accessing patented knowledge for innovation* (104529);[196] *Innovation at the base of the pyramid or iBOP* (105669),[197] and *Gender and innovation* (105359).[198] In addition, a number of multi-country projects helped bring researchers together. These included the BRICS project (104227)[199] which created a network of researchers from Brazil, Russia, India, China and South Africa to study national innovation systems); the megacities project (105180)[200] which brought together researchers from Thailand, Singapore, Philippines, Vietnam, Malaysia and Indonesia to examine innovations in six large cities; and the biosafety policy project (103577)[201] which created a global network of researchers from China, India, US, South Africa, Colombia, Honduras and Bolivia to work on socio-economic impacts of GMOs. These networks have not yet achieved concrete outcomes. The science journalism project (103349)[202] created global as well as national networks (in Jordan, Morocco, and Sudan) of science journalists who collaborate and learn from other. Outcomes related to the science journalism network have been presented in other sections of this report.

The *Socially inclusive innovations for development – lessons from rural China and India* project (105357)[203] has created a network of 16 development/public policy research institutes in China and India (eight in each country) who are currently engaged in joint research on innovations related to specific development challenges. These include poverty alleviation in dry-land agricultural areas, rural development through micro SMEs innovation and development, capturing knowledge and technology spillovers from R&D outsourcing by multinationals in China and India and enabling grassroots innovators to contribute to local and domestic markets. The governments of China and India have recently recognized the importance of building the capacity of young researchers in innovation by co-funding exchange fellowships. The National Science Foundation of China has contributed CAD $150,000 while the Indian Council for Social Sciences Research is supporting two PhD fellowships to train young researchers within the project.[204] This network of researchers in two neighboring countries is facilitating knowledge sharing and learning.

INTENDED BUT UNREALIZED PROGRAM OUTCOMES

The ITS Prospectus identified five expected outcomes for each of the three program objectives[205]. Intended but unrealized or only partially realized program outcomes include the following:

For *Objective 1*, *a better understanding of how innovation system actors in developing countries can enhance their learning capabilities with respect to innovation opportunities* has only be partially been achieved. Little information has been generated on *how developing country innovation systems connect to global innovation systems.* The program has focused on developing country systems, so this intended outcome was ambitious.

For *Objective 2*, the program has begun to focus more on innovation for poverty alleviation, but this line of work has not yet generated *tangible evidence serving to stimulate policy changes…in support of socio-economic development and poverty alleviation*. ITS has made little progress in helping countries *to improve understanding in negotiating and applying international agreements on IP to promote access to proprietary technologies and foster the creation of open access mechanisms.* Through its project on patents and innovation (104529) it has made some progress on applying international agreements. But helping countries negotiate international agreements and fostering the creation of open access mechanisms has not happened—these parts of the intended outcome were ambitious.

One of the main expected outcomes related to program Objective 2 was that the *evidence generated by ITS supported research would result in policy change and ultimately enhance innovation in developing countries*.[206] Although significant success can be claimed for the first part of this outcome (policy change), no evidence exists that these policies have improved the functioning of innovation systems in the countries studied. It often takes significant time for policies and practices to be put into practice, and for these to have an impact on what are often complex innovation systems. This particular outcome, outlined in the prospectus, was likely overoptimistic. Another point is the distinction made in the originally worded objective between explicit and implicit S&T policies. Although the work of the program was initially designed to cover types of policies, very little has been done so far on implicit policies such as taxation, labor and trade. However, ITS recently approved a new project that will be looking at how financial and investment policies influence innovation.

For *Objective 3*, an expected outcome was ~~"~~*enhanced multi-stakeholder participation and…gender equity*" in policy dialogues, risk management decisions or communications efforts associated with new technologies. The program has no research findings or outcomes related to gender equity and indeed few projects have explicitly looked at gender. As noted above, however, a global project on gender and innovation was initiated in 2009-10. In addition, a new project on biotechnology and gender equity and on innovation for women at the base of the pyramid is under development for 2010-11.

Another intended outcome from the prospectus was to improve results of ITS programming by partnering both internally within IDRC and externally with other funding agencies. Within IDRC, the scale of partnering on a small number of strategic projects was at about the right level. It was most successful with the ENRM program areas particularly on overlapping areas of interest such as genetic

resources policy, innovation in cities, and recently on the International Bar Code of Life. One might have expected more partnering on agriculture innovation. ITS also collaborated with the ICT4D program on ICT4D policy and recently on science policy on natural resources. [207]

ITS has been reasonably successful in partnering with other donor agencies to fund activities in parallel. [208] Among these are the British Department for International Development (DFID), the Swedish International Cooperation Agency (SIDA), the Rockefeller Foundation (RF) and the Canadian International Development Agency (CIDA), In particular, SciDev.Net has been better able to share knowledge on STI issues because of joint funding from SIDA, DFID and RF. The first phase of the successful science journalism project (103349) was equally funded by IDRC and DFID. The second phase about to be funded received substantial support ($3.3 million) from DFID. SIDA has also funded activities that have enhanced the last RoKs competition in parallel. The project on LAC's Natural Resource Industries (105165) received funding from CIDA.[209]

However, one area where ITS has not been successful to date has been in attracting funding from other donors to be administered by IDRC, defined as *co-funding*, within IDRC. Co-funding is not an end in itself, but rather a tool to achieve better outcomes from research support. But this mechanism does illustrate the confidence that other donors have in IDRC's intellectual leadership in a particular area. Because the program is new, and the research is only now beginning to demonstrate positive outcomes, co-funding is more likely in the second programming cycle than it was in the first. But this will have to be accompanied by concerted partnership efforts.

Finally, the prospectus anticipated considerable evaluation activity, but only six project evaluations have been conducted. At closer glance, though, this quantity seems reasonable. Of the 35 research projects supported, only seven have concluded, so additional evaluations would likely have been premature. Three evaluations are planned for the coming year. In addition, a terms of reference was drawn up for evaluating the STI policy reviews, but then the team was hit by staff shortages. Moreover, a comprehensive evaluation just before the External Review that interviewed some of the same recipients would be overkill.

STRATEGIC LESSONS AND CONCLUSIONS

The program has realized significant research findings under Objective 2 (the development of explicit and implicit STI policies), as well as Objective 3 (improving the methodology to assess socioeconomic impacts of GM crops on smallholder farmers).

At first glance, research findings for the first objective seem obvious—that developing countries have weak innovation systems. But the value added has been in building methodologies to analyze innovation systems in developing countries as well as in contributing to the body of literature on the developing countries NIS.

Outcomes presented in this report appear reasonable for the size and age of ITS. To some extent, the program has contributed to the following:

- A better understanding of the processes of innovation in developing countries, but although about one third of the budget was allocated to this Objective, a comprehensive understanding of the innovation system in any particular country is lacking.
- National-level STI policy influence as well as influence in particular themes, especially biotechnology. The development or review of STI policy is not academic research, and these may be better termed, ~~-s~~tudies", but it is still research. And this line of research has a very high return in terms of policy influence.
- A better understanding of impacts of new technologies, particularly biotechnology, on developing country communities. This may be the most useful outcome of ITS-supported research, as, particularly in developing countries, there is a lack of objective studies in this area.
- Sharing of STI knowledge. Supporting SciDev.net has proved to be a very effective way of disseminating STI knowledge, including some of the program's own research. As the program is completing its fourth year, it is also beginning to produce papers, books, and policy briefs—18 were published in 2008 and 36 in 2009).[210]
- Building capacity for the production, sharing, and use of STI knowledge; both through activities of several projects, as well as science journalism projects; and finally
- Strengthened networks of national and international STI researchers, which is critical for rigorous and effective research.

However, even with the above-noted areas of strength, a critical mass of projects and knowledge in particular themes are still lacking. The program does not yet have a well-developed body of work with depth that brands ITS, for two main reasons. First, the relatively small size of ITS compared to other IDRC programs means that only a limited number of research projects have been supported. Second, as a relatively new program, it was natural for ITS to initially explore a wide variety of projects within its defined Prospectus. Of the 39 research projects supported, only 7 have concluded and another 20 are coming to an end, so findings are still being clarified. Over time, this weakness will likely be rectified, as projects end, results become more apparent, and programming strengths and weaknesses are confirmed. This will enable the program to better define its focus and deepen its work. The challenge will be to ensure that it drops some lines of research as it supports more research in particular areas, such as innovation for and by the poor, or new areas such as creative industries.

Moreover, while some global projects have helped tie the program together, many of the research findings as well as the outcomes are somewhat disparate, with much more depth in LAC and South East Asia than elsewhere. This is not surprising as two of the three 100% Regional Program Officers are based in these regions, and staffing choices were deliberate at the outset of the program. South Asia programming has developed slower than in LAC and SE Asia, but is the third geographic area of focus in the program. Programming in the Middle East and North Africa (MENA) and Sub-Saharan Africa has necessarily been less deep, with only 30% position in West Africa and a single Ottawa-based Program Officer covering MENA and Eastern and Southern Africa.

As noted, several intended outcomes were unrealized, including a better understanding of how developing country and global innovation systems connect, helping developing countries negotiate international IP agreements and foster the creation of open access mechanisms, and improve the functioning of innovation systems. In retrospect, these outcomes appear optimistic for a five-year program. While the program has recently initiated some activities on gender, and plans more for 2010-11, it should have done more in this area earlier. The degree of internal partnering was reasonable, but more attention to partnering on agricultural innovation with the new Agriculture and Environment Program Area may need to be considered. Moreover, while funding projects in parallel with other donors on flagship initiatives such as SciDev and the Science journalism project have been successful, attracting funds to from other donors to be administered by ITS, has not. Now that the program is completing a cycle, and beginning to demonstrate positive outcomes, co-funding is more likely, but will have to be accompanied by concerted partnership efforts.

Significant ITS support has gone to its first objective on innovation systems, which is more academic than other research lines. Innovation is not easy to explain, or for those outside the field, to understand. Innovations systems are linked to ITS' second and third objectives. But they are not as compelling as sectors in which a country may have competitive advantage (second objective—STI strategies) or the benefits and risks of GM crops (third objective—impacts). So, beyond a small number of STI partners, it has been difficult for the program to articulate what it does, internally or externally. Thus, fundamental research into innovation systems may not have the same benefit/cost ratio for IDRC as other lines of research. While developing a comprehensive understanding of innovations systems is important, it may be better for ITS to leave this complex systems research as a stand-alone objective to others. However, innovations systems do still need to be considered and analyzed in the context of ITS's second objective on STI policies, and in addition, ITS can focus on specific players within innovation systems, such as universities and industries.

As already indicated, evidence in support of some outcomes presented in the report is incomplete. Clear baselines were not established at the outset of the program. Moreover, multiple sources of evidence are not available, and because of the age of the program, many of the outcomes are just emerging, and have not been fully tracked over time. Therefore, the role of the External Reviewers to verify these preliminary conclusions by examining more evidence, particularly those that are emerging, will be very helpful. All IDRC programs are being more methodical about how they frame intended outcomes in future stages, and ITS will need to be equally careful.

Between 2010-2015, the program plans to build on the above-noted lessons-learned, adjusted as appropriate following the External Review. Recent regional IDRC consultations identified the need for additional research on biotechnology and universities. In addition, three new areas will be explored—STI research granting councils as an important actor in national innovation systems, and creative industries and energy as two new themes.

NOTES

[1] Prior to this (October 2005), the BOG approved an Inception Report providing an overview of research activities to be carried under this program area (including ITS PI and the Challenge Fund). See Inception Report to the Board of Governors for Discussion, Richard Isnor, http://intranet.idrc.ca/en/ev-90668-201-1-DO_TOPIC.html

[2] RoKS website: www.idrc.ca/roks

[3] Emerging Technologies website: www.idrc.ca/biotech

[4] Innovation, Technology and Society. Program Initiative Prospectus for 2006–2011, June 2006, IDRC, Ottawa, ON, Canada. http://intranet.idrc.ca/en/ev-108901-201-1-DO_TOPIC.html

[5]The term ‗impact' was used in the Prospectus and so we have retained it in the report. However, we are aware of the current debate on outcomes and impacts and of the need to capture the systemic character of innovation and the processes involved. See for example, i) Hall, A., Rasheed Sulaiman, V., Clark, N. and Yoganand. B. (2003) Agricultural Systems 78: 213-241. ii) Godin, B. and Doré, C. (2005) Measuring the Impacts of Science: Beyond the Economic Dimension, INRS Urbanisation, Culture et Société, 44 p. Paper presented at: Helsinki Institute for S&T Studies, HIST Lecture, 24 August 2007, Helsinki, Finland; and International Conference Science Impact - Rethinking the Impact of Basic Research on Society and the Economy, Organized by the Austrian Science Fund (FWF) and the European Science Foundation (ESF), 10-11 May 2007, Vienna, Austria.

[6]New projects developed by ITS after Prospectus approval in 2006 (it does not include supplements, nor ITS contribution to other IDRC programs). Funding for these projects comes from: (1) ITS budget allocations; and (2) Forward Planning and Regional Office funds.

[7] Distribution of projects by regional office geographic area with breakdown of components from global projects into the respective regions.

[8] Project 104227: BRICS countries include Brazil, Russia, India, China and South Africa

[9] Project: Integrated Policies for Bio-Innovation in Agriculture and Health (Asia -104041)

[10] Project: Peer-to-Peer Support for Science Journalism in the Developing World (103349); Project: Core Support to the Science and Development Network, SciDev.Net - Phase III (103104)

[11] IPS Strategic Review meeting – February 2009, http://irims.idrc.ca/getDocument.asp?documentNumber=184979

[12] See ITS Prospectus, Programming Modalities, p. 27. http://intranet.idrc.ca/en/ev-108901-201-1-DO_TOPIC.html

[13] See Paragraphs 12, 42, and 52, of IDRC's Corporate Strategic Framework 2010-2015. http://www.idrc.ca/en/ev-149574-201-1-DO_TOPIC.html

[14] ITS prospectus, page 30. http://intranet.idrc.ca/en/ev-108901-201-1-DO_TOPIC.html

[15] ITS Program Team Composition. February, 2010. http://intranet.idrc.ca/en/ev-149365-201-1-DO_TOPIC.html

[16] Full Time Employee (FTE)

[17] Program started the year with 4.55 PO FTEs. With the departures of Rob Robertson in April 09 (0.25 FTE), Gustavo Crespi in June 09 (1 FTE), and Jean Woo in July 09 (1 FTE), the program was

down to 2.3 FTEs. New staff Fernando Santiago (1 FTE) was hired in January 10, and Isabel Bortagary (1 FTE), in February 10.

[18] Faruqui, Naser. "ITS Strengths and Weaknesses", Document tabled at the October 2009 Board of Governors meeting. http://irims.idrc.ca/getDocument.asp?documentNumber=258616

[19] The RoKS Competitive Grants Program had the overall objective to explore, from a developing country standpoint, the ways in which knowledge is produced, communicated, and applied to development problems, and the policy and institutional frameworks which govern this process. RoKS was designed to establish annual research competitions on specific themes. These small grant competitions served as a mechanism to explore new programming themes and provide a test-bed for informing potential future ITS research initiatives at local, national and international levels. They also helped to identify and support new generations of researchers in the South, as well as facilitate potential linkages with their counterparts in developed or other developing countries (www.idrc.ca/roks).

[20] Lee, K, Joseph, K.J., Abraham, V., Eun, J-K, Wu, G., Wang, Y., Rasiah, R., Govindaraju, C., Intarakumnerd, P., Schiller, D., Cho, H-D., Eom, B-Y., Kang, R. June, 2009. Promoting Effective Modes of University-Industry Linkages and their Evolution for Economic Catch-up in Asia. Final technical report. Chapter 7: Synthesis and Summary. http://irims.idrc.ca/getDocument.asp?documentNumber=208194

[21] The list of books and other publications resulting from ITS-funded projects are accessible from http://www.idrc.ca/en/ev-33969-201-1-DO_TOPIC.html

[22] Albuquerque, E., Lee, K, and Kruss, G. (forthcoming). University-industry linkages and catch-up: insights from Asia, Latin America and Africa. Draft manuscript chapters are planned to be presented at a meeting in the Spring 2010.

[23] Márcia Siqueira Rapini, Eduardo da Motta e Albuquerque et al. June, 2009. University–industry interactions in an immature system of innovation: evidence from Minas Gerais, Brazil. *Science and Public Policy*, 36(5), pp. 373–386 http://irims.idrc.ca/ViewDocument.asp?Key=PPB+232%2D01%2D103470%2D017+UNC+208100

[24] Pereira, Angela. October, 2009. University-Industry Collaboration: Jump-Starting Innovation. *IDRC Bulletin* Project # 103470 http://www.idrc.ca/en/ev-147080-201-1-DO_TOPIC.html

[25] National Innovation Systems of BRICS countries

[26] This comparison was based on three inter-dependent sub-systems (production/ demand, science/ technology, and education)

[27] These trends are worrying as previous research for the OECD countries suggests that defense R&D has lower social return rates than civil R&D. Although it is still too soon to conclude that the same holds for BRICs, evidence gathered so far suggests that reallocation of public investments away from defense towards civil goals might increase the socio-economic impacts of BRICs innovation. See Star project 104227 profile at http://irims.idrc.ca/getDocument.asp?documentNumber=215614 and paper by Guellec, D and B. Van Pottesllberghe de la Potterie. 2004. From R&D to Productivity Growth: Do the Institutional Settings and the Source of Funds of R&D Matter?, *Oxford Bulleting of Economics and Statistics,* 66, 3, 353-378

[28] Developing innovations for the domestic market has become a key policy priority of the Chinese government.

[29] Veena Ravichandran, Trip Report: http://irims.idrc.ca/irims/ViewDocument.asp?Key=PPB+129%2D03%2D127+UNC+230260

[30] See trip report Fernando Perini who participated in November Workshop http://irims.idrc.ca/irims/ViewDocument.asp?Key=LACDIR+129%2D03%2D17+UNC+233497

[31] Meeting presentations available in the project web site: http://brics.redesist.ie.ufrj.br/proj_idrc/index.php

[32] Project: R&D Cooperation and Appropriability in LA Innovation Strategies: Empirical Evidence and Policy Implications from National Systems of Innovation Surveys in Latin America and the Caribbean (104574)

[33] Argentina, Brazil, Chile, Mexico and Uruguay participated in the study.

[34] The empirical analysis also seems to confirm the importance of size, quality of human resources of the firm; public support also appears to affect the probability to cooperate. Project Monitoring Report. April, 2009 http://irims.idrc.ca/getDocument.asp?documentNumber=196790

[35] Project Monitoring Report. April, 2009 http://irims.idrc.ca/getDocument.asp?documentNumber=196790

[36] Project: Regional Innovation Policies in MERCOSUR: Obstacles and Opportunities (104958). Interim Technical Report. Centro Redes and CEFIR. September, 2009. Políticas regionales de Innovación en el MERCOSUR: obstáculos y oportunidades. http://irims.idrc.ca/getDocument.asp?documentNumber=236394

[37] The PROSUL and the BIOTECH were the most relevant successful programmes. About PROSUL at IDRC-PBDD. December, 2007. Emerging Donors in International Development Assistance: The Brazil Case www.idrc.ca/uploads/user-S/12447281201Case_of_Brazil.pdf.

[38] BIOTECH: Plataforma de Biotecnologías BIOTECSUR http://www.biotecsur.org/

[39] Accessing patented knowledge for innovation (104529). Ravichandran, Veena. November, 2009. Workshop 20-21 October 2009 Report http://irims.idrc.ca/getDocument.asp?documentNumber=238246

[40] Compulsory license: governments can require a patent holder to grant the use of the patent to the government or to a third party if the patent is needed to create a public good technology or service. The patent holder may be compensated by royalties or by some form of arbitration.

[41] A patent pool is a group of at least two firms agreeing to license to each other their patents on a particular technology. This saves time and money for the patent holders and the licensees.

[42] Project: Indigenous Technological Innovation Capability and Competitiveness in China's Western Region (103933). MOST. June, 2009. 2nd Interim Technical Report http://irims.idrc.ca/getDocument.asp?documentNumber=249126

[43] This grant allowed the Ministry of Science and Technology (MOST) to undertake a three-year project designed to enhance indigenous technological innovation and competitiveness in the western region. The project was implemented through a competitive process involving an annual call for proposals on specific themes, as determined by a Steering Committee of experts drawn from government agencies, universities and research institutions all over the country. China's MOST matched IDRC contribution of $500,000CAD.

[44] MOST. Brief Summary of Manufacturing and Agricultural Industry Research of Project 103933 http://irims.idrc.ca/getDocument.asp?documentNumber=254910

[45] Knowledge to Innovation in Solid Waste Services in Sri Lanka. Interim Project Evaluation Report – First Draft, December 2009. Project # 104356-001 http://irims.idrc.ca/getDocument.asp?documentNumber=254405

[46] National Plant Protection Organizations (NPPOs)

[47] Project: Knowledge networks and systems of innovation to support implementation of sanitary and phytosanitary standards (SPS) in Southeast Asia (103929). CABI. June 2008. Final Technical Report. Project # 103929 http://irims.idrc.ca/getDocument.asp?documentNumber=179883

[48] Toward a National Science and Technology Policy in Nicaragua (105164), CEPAL. 2009. First Interim Technical Report. Project # 105164 http://irims.idrc.ca/getDocument.asp?documentNumber=216554

[49] Project # 105164 Outline http://irims.idrc.ca/getDocument.asp?documentNumber=244366

[50] Woo, Jean. July, 2007. Project completion report (PCR) 103350. Science and Technology Policy for Mozambique. Project #103350 http://irims.idrc.ca/getDocument.asp?documentNumber=110884

[51] Botelho, Antonio José Junqueira. Final Mission Report, 8 November 2006, Project #103350 http://irims.idrc.ca/getDocument.asp?documentNumber=206387

[52] Project: Supporting biosafety policy decisions: best practices for assessing the socio-economic impacts of transgenic crops on small scale farmers (103577). Star project profile at http://irims.idrc.ca/getDocument.asp?documentNumber=223802

[53] Smale, M., J. Falck-Zepeda, P. Zambrano, G. Gruère, I. Yerramareddy, A. Niane, and H. Jones. 2008. *Supporting biosafety policy decisions: "Best practices" for assessing the social and economic impacts of transgenic crop varieties n small-scale farmers. Final technical report* International Food Policy Research Institute (IFPRI), Regional Office for Southeast and East Asia, Singapore, Project # 103577 http://irims.idrc.ca/getDocument.asp?documentNumber=225164

[54] Biosafety Management of Genetically Modified Crops in China (103783) , Star Project Profile http://irims.idrc.ca/getDocument.asp?documentNumber=223804

[55] Huang, Jikun, Deliang Zhang, Jun Yang, Scott Rozelle and Nicholas Kalaitzandonakes. 2008. Will the Biosafety Protocol Hinder or Protect the Developing World: Learning from China's Experience. *Food Policy*, 33, pp: 1-12.

Wang, Zijun, Hai Lin, Jikun Huang, Ruifa Hu, Scott Rozelle and Carl Pray. January, 2009. *Bt* Cotton in China: Are Secondary Insect Infestations Offsetting the Benefits in Farmer Fields. *Agricultural Sciences in China.* Vol. 8 (1): 101-105.

[56] Huang, Jikun, Hai Lin, Ruifa Hu, Scott Rozelle and Carl Pray. 2007. Impacts of Adoption of Genetically-modified Insect-Resistant Cotton on Usage of Pesticides Targeted at Less-dangerous Insects. *Journal of Agrotechnical Economics*, No. 1, pp: 4-12.; Huang, Jikun, Liang Qi, Ruijian Chen. 2008. The Knowledge about Technology Information, Risk Preferences and Farmers. Application of Pesticides, *Management World*, No. 5, pp: 71-76.

[57] Huang, Jikun, Jianwei Mi, Hai Lin, Zijun Wang, Ruijan Chen, Ruifa Hu, Scott Rozelle, and Carl Pray. 2009. A Decade of Bt Cotton in Farmer Fields in China: Assessing the Direct Effects and Indirect Externalities of *Bt* Cotton Adoption in China, *Science in China*.

[58] Monitoring report: Capability, Governance, and Nanotechnology Developments: a focus on India, August 19, 2009, Project # 104068 http://irims.idrc.ca/getDocument.asp?documentNumber=237903

[59] The Energy and Resources Institute (TERI). October, 2009. WP 2: Issues involved in Life Cycle Analysis of nanoproducts: a case study of nanosilver based candle filter. Project Report. New Delhi, India: TERI, 2006ST21, Project # 104068 http://irims.idrc.ca/getDocument.asp?documentNumber=238625.

[60] Oyelaran-Oyeyinka, B. 2006. Innovation Policies and Practices in Developing Countries: A Methodological Framework. Background Research Paper Prepared for the IDRC Innovation, Policy and Science Program Area, Ottawa.

[61] Crespi, G. 2009. STPR and IDRC summary. Science and Technology Policy Reviews: What do we do with them. http://irims.idrc.ca/getDocument.asp?documentNumber=250535

[62] Project: Country Review of Science and Technology Policy (Colombia - 870316)

[63] Project: Science and Technology Policy Research Centre (South Africa – 001996)

[64] Project: Chinese National Strategy for International Science and Technology Cooperation (040372)

[65] Project: Science and Technology Strategy (STS) Framework (Vietnam - 040377)

[66] Project: Development of a New Science, Technology and Innovation Strategy for Vietnam (106101)

[67] Project: Chile Science and Technology Evaluation (050348 / 050332 / 100090)

[68] Project: Science and Technology Policy Review 2008, University Research Funding in Chile (104956)

[69] Project: Science, Technology and Innovation Policy Review (Jordan - 100908)

[70] Project: Developing a Science and Technology (S&T) Policy for Mozambique (103350)

[71] Project: Pilot project – National Development Research Program (102560)

[72] Project: Aligning the National S&T Policy with the National Sustainable Development Strategy in Sri Lanka (104357).

[73] Project: Toward a National Science and Technology Policy in Nicaragua (105164)

[74] Project: Panama's Science and Technology Policy Review 2005-2009 (105427)

[75] Project: Toward an Innovation-led Development Path in the Philippines (105177)

[76] Voyer, Roger. 2006. A critique of national science, technology and innovation reviews. In *Future directions for national reviews of science, technology and innovation in developing countries.* eds. Paul Dufour, Foralin Osotimehin. Paris, France: UNESCOProject # 101799 http://idl-bnc.idrc.ca/dspace/handle/123456789/34631

[77] Letter from Ruben Berrocal (NationalScience Technology and Innovation Secretary) to F. Burone, 23-Feb-2010 Available at: http://irims.idrc.ca/getDocument.asp?documentNumber=251084

[78] Massingue, Venancio. 2010. Creating prosperity through innovation. Presented at the Conference Africa's New Frontier: Innovation. Technology. Prosperity, February 4-5, 2010, Ottawa, ON, Canada. Project # 103350 http://irims.idrc.ca/getDocument.asp?documentNumber=249379

[79] Policy Brief (Project # 03783): Modern biological technique' effects on food security and trade in China http://irims.idrc.ca/getDocument.asp?documentNumber=234014; Policy Brief (Project # 03783): Policy Recommendations on Research and Commercialization of GM Crops http://irims.idrc.ca/getDocument.asp?documentNumber=234015; Policy Brief (Project # 03783): Recommendation on strengthening the management of seed market in China http://irims.idrc.ca/getDocument.asp?documentNumber=234016

[80] Huang, Jikun. 2009. *Biosafety management of generically modified crops (China): Final technical report.* Center for Chinese Agricultural Policy (CCAP), Chinese Academy of Science (CAS), Beijing, CN, Project # 103783 http://irims.idrc.ca/getDocument.asp?documentNumber=198222

[81] Ibid.

[82] The State Council of China and the Ministry of Agriculture decided to invest 190 million Yuan ($28m) in this field, of which ca. 90 million Yuan ($13m) was earmarked for studies on biotechnology impact, policy and regulation studies between 2008 and 2010. The latter initiative is led by CCAP.

[83] Project: Recommendations on Strengthening the Management of Seed Market in China (103783)

[84] Huang, Jikun. 2009. *Biosafety management of generically modified crops (China): Final technical report.* Center for Chinese Agricultural Policy (CCAP), Chinese Academy of Science (CAS), Beijing, CN, Project # 103783 http://irims.idrc.ca/getDocument.asp?documentNumber=198222

[85] International Food Policy Research Institute (IFPRI). 2008. *Supporting biosafety policy decisions: "best practices" for assessing the social and economic impacts of transgenic crop varieties on small-scale farmers.* Singapore: International Food Policy Research Institute (IFPRI), Regional Office for Southeast and East Asia, Project # 103577
http://irims.idrc.ca/getDocument.asp?documentNumber=225164

[86] E-mail from Patricia Zambrano (IFPRI): Impact of IFPRI-CONALGODON Research Project.
http://irims.idrc.ca/getDocument.asp?documentNumber=254911

[87] Instituto Colombiano Agropecuario (ICA)

[88] International Food Policy Research Institute (IFPRI). 2008. *Supporting biosafety policy decisions: "best practices" for assessing the social and economic impacts of transgenic crop varieties on small-scale farmers.* Singapore: International Food Policy Research Institute (IFPRI), Regional Office for Southeast and East Asia, Project # 103577
http://irims.idrc.ca/getDocument.asp?documentNumber=225164

[89] Executive Order 514 establishes the National Biosafety Framework, prescribes guidelines for its implementation, and strengthens the National Committee on Biosafety of the Philippines; scope and objectives; administrative framework and decision-making processes; general mandate on departments, offices and agencies; funding and transition.
http://irims.idrc.ca/getDocument.asp?documentNumber=233807

[90] E-mail from Caleda, Mary Jean. November 18, 2009. Project # 103577
http://irims.idrc.ca/iRIMSTemp/111031CE-1330-4119-8E0B-8534F4A63AE8-5404/rad64597.HTM

[91] Project: Knowledge networks and systems of innovation to support implementation of sanitary and phytosanitary standards (SPS) in Southeast Asia (103929)

[92] CABI. June, 2008. *Knowledge networks and systems of innovation to support implementation of sanitary and phytosanitary standards in the developing countries of South East Asia.* Project # 103929 http://irims.idrc.ca/getDocument.asp?documentNumber=179883

[93] For example, the Malaysian Department of Agriculture held a 5-day workshop entitled *Understanding and Developing Risk Management Options for Market Access* in October 2008 where, for the first time, participants from industry (exporters and importers) took part. The participants came from the Association of Southeast Asian Nations (ASEAN). Malaysia plans to further reinforce the usefulness of multistakeholder engagement through other workshops organized with the support of Asian Pacific Economic Community (APEC).

[94] A workshop supported by APEC on *Enhancing Food Security through a Regional Approach and Wide Stakeholder Participation to Plant Biosecurity* is planned for 2009/2010.

[95] Recent missions by CABI staff revealed that the National Plant Protection Organizations (NPPOs) in Cambodia and Lao PDR are beginning to engage with local universities on pest surveys and identification. Evidence for this growing mutually beneficial relationship also comes from the open support voiced by the NPPOs for capacity building efforts to include universities

[96] CABI. June 2008. *Final technical report: Knowledge networks and systems of innovation to support implementation of sanitary and phytosanitary standards in the developing countries of south East Asia.* Project # 103929 http://irims.idrc.ca/getDocument.asp?documentNumber=179883

[97] Project: Innovation Systems for Inclusive Development: Lessons from Rural China and India (105357)

[98] Chinese Academy of Sciences (CAS). June, 2009. *Official letter (letter from CAS leadership acknowledging CCAP policy brief was seen and approved by Hu Jintao, Hui Liangyui and Li Yuanchao)* Document in Chinese. Project # 105357
http://irims.idrc.ca/ViewDocument.asp?Key=PPB+232%2D01%2D02%2D105357%2D001+UNC+237601;
E-mail from McGurk, Stephen, October 6, 2009,
http://irims.idrc.ca/ViewDocument.asp?Key=PPB+232%2D01%2D02%2D105357%2D001+UNC+253094;
E-mail from Ravichandran, Veena. October 6, 2009.
http://irims.idrc.ca/ViewDocument.asp?Key=PPB+232%2D01%2D02%2D105357%2D001+UNC+237601

[99] Research Center for Innovation and Development (RCID). September, 2009. *Application of total innovation management to leverage innovation capabilities of Chinese small & medium sized enterprises, interim technical report.* Project # 104044
http://irims.idrc.ca/getDocument.asp?documentNumber=227483

[100] Perini, Fernando. November, 2009. Trip report, p.13
http://irims.idrc.ca/irims/ViewDocument.asp?Key=LACDIR+129%2D03%2D17+UNC+233497

[101] Gang, Zhao (MOST) December, 2009. Report. Project # 103933
http://irims.idrc.ca/ViewDocument.asp?Key=ASPRG+232%2D01%2D02%2D103933+UNC+252984

[102] Project: Toward Innovative, Liveable and Prosperous Asian Megacities (105180)

[103] Project: Towards Innovative, Liveable and Prosperous Asian Megacities (105180). The First Interim Technical Report was received in February 2010, the responsible PO has requested the researchers to clarify some aspects of the report. The final version will be filed in Livelink shortly. E-mail correspondence from Ratanawaraha, Apiwat. February 22, 2010:
http://irims.idrc.ca/getDocument.asp?documentNumber=249755

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[208] These partnerships have leveraged additional funds to the respective projects to the tune of more than $11 million CAD for currently active projects, mostly as parallel funds, see http://irims.idrc.ca/getDocument.asp?documentNumber=257337. Other examples are projects 103933, in which the China's Ministry of Science and Technology provided matched ITS CAD $500,000 to the project; and project 105357, in which the National Science Foundation of China provided a special grant of CAD $ 150,700 to the project.

[209] Examples of ITS partnerships with other international donors also dedicated to the support of research for development are: the British Department for International Development (projects 103104, 103311, 103349, 105598), the Swedish International Cooperation Agency (projects 105572, 105598), the Rockefeller Foundation (projects 103104, 103311, 1043239, and the Canadian International Development Agency (projects103311, 104323, 105165). Including also the IADB (105160), OAS (104958), OECD (105572), WHO (105168), Genome Canada (104043), UNDP (105168), and the Ford Foundation (104323).

[210] List of research outputs of closed projects. Document # 23 of Program Evaluation document list.

ANNEX 1: ITS KEY INFORMANTS AND REFERENCES

OUTCOME 1: ITS PROJECTS HAVE CONTRIBUTED TO POLICY INFLUENCE

I) POLICIES BASED ON STI POLICY REVIEWS:

Key informants

Key informant	E-mail address	Relevance
Ellie Osir (Singapore)	eosir@idrc.org.sg	IDRC's Responsible Officer for project Development of a New Science, Technology and Innovation Strategy for Vietnam Project Number 106101
Federico Burone (Montevideo, Uruguay)	fburone@idrc.org.uy	IDRC's Regional Director for Latin America and the Caribbean; replacing the former Responsible Officer for the Science and Technology Policy Review 2008 : University Research Funding in Chile Project Number 104956
Rolando Bú (Honduras)	fedepresidente@cablecolor.hn	Federacion de Organizaciones Privadas de Desarrollo de Honduras (FOPRIDEH). Grantee and Project Leader for Pilot project – National Development Research Program (Honduras) Project Number 102560
Dr. Mohan Munasinghe (Sri Lanka)	mohan@mindlanka.org	Munasinghe Institute for Development (MIND int). Grantee and Project Leader for project: Aligning the National S&T Policy with the National Sustainable Development Strategy in Sri Lanka

		Project Number 104357
Marcelino E. Sales Lucas (Mozambique)	marcelino.lucas@mct.gov.mz	National Director for Planning, Statistics, Ministry of Science and Technology of Mozambique. Grantee and Project Leader for theScience and Technology Policy for Mozambique Project Number 103350
Gustavo Crespi (Washington, USA)	gcrespi@iadb.org	Inter-American Development Bank, Multilateral Investment Fund. Former IDRC Responsible Officer for the Science and Technology Policy Review 2005-2009 (Panama) Project Number 105427
Fortunato T. De la Pena (Manila, Philippines)	ftdp@dost.gov.ph	Department of Science and Technology, Philippines. Grantee and project leader for project: Toward an Innovation-led Development Path in the Philippines Project Number 105177
Mario Cimoli (Santiago, Chile)	mario.cimoli@cepal.org	Economic Commission for Latin-America and the Caribbean (ECLAC) Project Leader for the project: Toward a National Science and Technology Policy in Nicaragua Project Number 105164

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II) POLICIES RECOMMENDATIONS FROM SELECTED ITS PROJECTS:

Key informants

Key informant	E-mail address	Relevance
Fernando Perini (Montevideo, Uruguay)	fperini@idrc.ca	IDRC's Program Officer with the ICT4D program area, based in the LACRO Regional Office. Provided useful support to many projects in the region after the departure of former ITS-PO Gustavo Crespi
Jikun Huang (Beijing, China)	jkhuang.ccap@igsnrr.ac.cn	Center for Chinese Agricultural Policy (CCAP). Grantee and Project Leader for project: Biosafety Management of Genetically Modified Crops (China) Project Number 103783
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OUTCOME 2: ITS PROJECTS HAVE CONTRIBUTED TO A BETTER UNDERSTANDING OF THE IMPACTS OF EMERGING TECHNOLOGIES ON DEVELOPING COUNTRY COMMUNITIES

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OUTCOME 3: ITS PROJECTS HAVE IMPROVED SHARING OF STI INFORMATION, KNOWLEDGE, AND EXPERIENCE

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OUTCOME 4: ITS PROJECTS HAVE BUILT THE CAPACITY FOR PRODUCTION, SHARING AND USE OF STI KNOWLEDGE

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OUTCOME 5: ITS PROJECTS HAVE BUILT PARTNERSHIPS AND STRENGTHENED REGIONAL AND INTERNATIONAL NETWORKS OF RESEARCHERS AND POLICY-MAKERS

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